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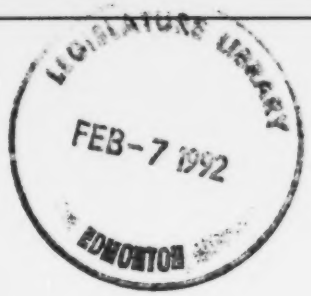

1990 ANNUAL REPORT

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

Alberta
AGRICULTURE

1990 ANNUAL REPORT

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

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Post-Harvest
Specialist and Plant
Pathologist

DIRECTOR'S REPORT

The Alberta Special Crops and Horticultural Research Center (ASCHRC) is a branch of Alberta Agriculture's Plant Industry Division. Its staff conduct applied research, extension and development programs working cooperatively with other research organizations.

Crop diversification and industry development are achieved through close contact with industry organizations and commodity groups. For example, as th Alberta greenhouse industry has expanded our research with biological control agents has had a direct impact on pest management practices. Research in potatoes has demonstrated that seed piece management is a critical step in the production of quality potatoes.

An agreement with the Chinook Applied Research Association at Oyen will see them conduct variety testing of cereals, oilseeds, forages and special crops in the Special Areas. This substantially reduces costs we incur by doing research at remote locations. A research and development agreement with Purdue University will foster the development of basil as a crop in Alberta. They will supply lines of basil high in methyl cinnamate to ASCHRC from which we will select those adapted to southern Alberta conditions.

The development of an irrigated grass seed industry was supported through studies on fertilizer requirements, salinity tolerance and disease incidence. Our work with salinity mapping was intensified by the initiation of a cooperative project with the University of Calgary, Survey Engineering Department.

Staff helped to organize and participated in the Alberta Horticulture Congress, an excellent opportunity to meet with horticultural commodity groups thereby enhancing our own extension coverage. Staff changes during 1990 included the appointment of Cathy Feth (Potato Technologist), Mike Blades (Vegetable Technologist), Dr. Mason Robertson (Nursery Crops Specialist) and Dr. Janet Panford (Food Scientist).

Program funding was generally from line budgets, however some projects were funded by other groups: essential oil crop production and salinity tolerance by Farming for the Future; cereal, oilseed, and forage variety testing by the Field Crops Branch; Dutch Elm Disease monitoring by several urban municipalities; and potato storage disease research by the Alberta Potato Research Association.

The Advisory Committee met once during 1990. Detailed reviews were conducted for the Vegetable, Soil and Water, Field Crops, Special Crops, Plant Pathology and Regional Crops Laboratory programs.

This annual report provides a good overview of the scope of research projects conducted here. More information is available on request.

Thomas R. Krahn, P.Ag.
Director

ADMINISTRATIVE SERVICES SECTION

The section provides administrative support including purchasing, accounting, budgetary control, personnel services, library and hostess activities, computer and automated information processing, and general office management. It also serves as the contact with Project Management staff of Alberta Public Works Supply and Services.

Thomas R. Krahn, B.Sc. (Ag), M.Sc., P.Ag. ..... Director
Huber Ellis ..... Administrative Officer
Priscilla Petersen ..... Secretary & Personnel
Anna Moeller ..... Accountant
Betty Ann Humphreys ..... Receptionist & Timekeeper
Joyce Clark ..... Librarian & Hostess

The Honourable Ernie Isley, Minister of Agriculture and Tom Musgrove, M.L.A. for Bow Valley, officially opened the P.D. Hargrave Building Addition on April 27, 1990.

ASCHRC hosted its annual field day on August 24. Cold, rainy weather limited attendance to approximately 1100 visitors. Field day continues to be an important part of our overall extension program and public relations. Staff also hosted commodity group tours, seminars and field days. These efforts are an excellent means of facilitating technology transfer.

Operational budgets continued to be reduced. Travel, material and supply purchases, fixed asset purchases and casual manpower hiring were all affected.

SITE OPERATIONS SECTION

This section was responsible for the grounds, farm operations, machinery/vehicle maintenance and shop operation, activities of the stockkeeper and the Occupational Health and Safety Program. Site development, shelterbelt planning, planting and maintenance, irrigation system maintenance, mechanical preventative maintenance, land preparation and weather services are other major areas of responsibility.

Joe Chomistek, B.Sc. (Ag), P.Ag. ..... Site Manager
Henry Christesen ..... Farm Manager
William Coffey ..... Stockkeeper
Roland Williams ..... Senior Mechanic
Barry Merkl ..... Mechanic
William Wise ..... Farm Worker
Randy Hellmer ..... Farm Worker
Greg Feth ..... Grounds Technologist

An initial planting of shelterbelts was established at the Bow Island Substation. Office trailers were moved from Brooks to Bow Island.

The grounds irrigation system at the the ASCHRC was upgraded. Several areas including the arboretum and the entrance road area were added to the underground automated system.

Plans were developed to replace the production greenhouses, as the final phase of the Hargrave Building Addition.

HORTICULTURAL CROP PRODUCTION SECTION

Programs in the Horticultural Crop Production Section provide research and extension services for Alberta's horticultural industries. The objectives of the section are:

- to improve the quality of horticultural crops produced in Alberta;
- to increase profits for producers by increasing yields and optimizing management inputs; and
- to promote the development of horticultural crop production.

Industries supported include: fresh, processed, and seed potato; fresh and processed vegetable; greenhouse flower and vegetable; nursery and landscaping; and small and native fruit. Most of the programs include both cultivar evaluation and production research. Extension activities include workshops, short courses, field days, study groups, and individual consultation.

Section Administration and Potato Program

Clive A. Schaupmeyer, B.Sc. (Ag), M.Sc., P.Ag. ..... Section Head and Potato Specialist
Mayumi Tanigami-Bunney ..... Secretary
Cathy Feth, Dipl. Hort., B.S.A. ..... Technologist

Vegetable Crops

Paul Ragan, B.Sc. (Ag), M.Sc., Ph.D. ..... Research Horticulturist
Mike Blades, Dipl. Hort. ..... Technologist

Fruit Crops

Lloyd Hausher, B.Sc. (Ag) ..... Research Horticulturist
Te-Sen Pih, B.Sc., M.Sc. ..... Technologist

Ornamentals, Nursery Crops

J. Mason Robertson, B.A., B.Sc., Ph.D. ..... Research Horticulturist
Nigel Seymour, Dipl. Hort. ..... Technologist

Greenhouse Crops

Judy Butt, B.Sc. (Ag), M.Sc., P.Ag. ..... Research Horticulturist
Murray Briant, Dipl. Hort. ..... Technologist

POTATO PROGRAM

Program Leader: C. Schaupmeyer
Technologist: C. Feth

The objectives of the Potato Program are:

- to assist in the selection and development of improved potato cultivars and
- to establish methods for improving quality and maximizing economic yields in Alberta's potato industry.

This is accomplished through research, extension, and service.

RESEARCH PROJECTS

Potato Cultivar Improvement

Prairie Potato Regional Trials

The ASCHRC cooperates in the Prairie Regional Potato Trials to select improved potato cultivars for Alberta's potato industry. Approximately 300 cultivars were grown for evaluation in five trials: the Prairie Adaptation Trial, two Advanced Adaptation Trials, the Prairie Early Replicated Trial, and the Prairie Replicated Trial. Data were collected on a maximum of 39 observations and measurements for each entry in the trials. The Center also participates in the North Central Trial coordinated by North Dakota State University.

The data were compiled and transmitted to D. Lynch, the potato breeder at Agriculture Canada, Lethbridge. Results of the regional trials are not published, however, information on clones in the trials can be obtained by contacting the ASCHRC, or D. Lynch, Agriculture Canada, Lethbridge.

Alberta potato industry cultivar evaluation

The Potato Industry Cultivar Trials were established to evaluate on a commercial field scale new potato cultivars that have graduated from the Prairie Potato Regional Trials. The industry trials enable growers and processors to gain first-hand experience with new cultivars in the field and processing plant. Potato growers and staff from Hostess Foods Products Ltd., Old Dutch Foods Ltd., York Farms Division of Canada Packers Inc., normally cooperate with ASCHRC staff in the Potato Industry Cultivar Trials.

Progress made in the past five years with industry evaluation of promising lines was severely disrupted in 1989 because the Center was shipped a small quantity of seed contaminated with bacterial ring rot. There were no industry trials in 1990 as seed grown in 1989 was destroyed to prevent possible contamination of commercial farms.

Potato Cultural Improvement

The results of potato cultural studies conducted between 1985 and 1988 are reported in *Potato Cultural Trials 1985-1988*, ASCHRC Pamphlet 89-8. Detailed information on 1989 and 1990 trials will be provided to those requesting *Potato Cultural Trials 1989-1990*, ASCHRC Pamphlet 91-19.

Ten cultural projects were conducted in 1990:

- Effects of planting date and spacing on Russet Burbank, Norchip and Superior (5 trials - second year).
- Effects of in-row spacing on Amisk and Niska (2 trials - first and second year).
- Effects of high-density spacing on Norchip and Russet Burbank (2 trials - second year).
- Effects of small whole seed tuber weight and spacing on Russet Burbank (1 trial -first year).

These studies measured the effects of the various treatments on the yield, quality and size distribution of harvested tubers.

Service Projects and Extension

The ASCHRC potato program propagated seed of approximately 150 cultivars for the Prairie Potato Breeding Program regional trials in Alberta, Saskatchewan and Manitoba. Approximately 300 hills each of advanced seedlings and 50 hills each of early lines were grown, stored at ASCHRC, and subsequently shipped to other cooperators in the prairie provinces.

The Potato Specialist provides extension service to growers and industry personnel through direct contact, newsletters and factsheets, and presentations at conferences and workshops. The *Alberta Potato Production Guide* is currently being revised and will be available for the 1992 planting season.

VEGETABLE PROGRAM

Program Leader: P. Ragan
Technologist: M. Blades

The Vegetable Program serves the fresh and processing sectors of Alberta's expanding vegetable industry through applied field research and industry extension activities. The fresh vegetable industry in Alberta consists of both commercial (wholesale) and market garden producers. Processing growers provide vegetables for the canning and freezing industry. Variety evaluation and earliness enhancement of crops through improvements in cultural management are the main research activities of the Vegetable Program. Education and information transfer are carried out through on-farm visits and participation in commodity organization's conferences and workshops.

Research Projects

Variety Evaluation

Details of results on varieties tested are reported in the ASCHRC Pamphlet 91-5 *Vegetable Variety Trials - 1990.*

In 1990, 650 varieties of 18 types of vegetables were evaluated. Direct seeding and transplanting, dates of planting, and successive seeding regimes of many types of vegetables were evaluated. Many of the entries are advanced breeding lines from Europe and the United States. The quality of storage crops such as carrots, cabbage, cooking onions and acorn squash were evaluated in 4- and 6-month storage trials.

Cultural Trials

Detailed results of cultural trials and discussions of results are reported in ASCHRC Pamphlet 91-4 *Vegetable Cultural Trials - 1990.*

Summer squash in-row plant spacing trial

The summer squash variety, Super Select planted 90 cm between rows was grown at 90-, 60- and 30-cm in-row spacings in a 4-replicate trial. Less fruit per plant was produced over the entire season as in-row spacing decreased, however, because of increased plant numbers, yield per plot increased significantly. Closer in-row spacing encouraged earlier fruit production.

Despite the advantage of higher yield with closer in-row spacing, considerable difficulty was experienced in harvesting the 30-cm treatment. Because weak stems caused plants to lodge, most fruit was found close to the ground tangled among leaves and vines. A wider than 90-cm spacing between rows would be recommended when planting at a 30-cm in-row spacing.

Garlic planting depth and spacing trial

The variety, Early California, was planted in the fall at 4 and 1 cm depths at 10 and 5 cm in-row spacings and overwintered to evaluate response the following season. A greater percentage of cloves planted 4 cm deep survived the winter than those planted 1 cm deep. Higher plant densities produced greater yield, however, the closer spacings reduced bulb size.

Pepper and slicing cucumber mulch trial

Four plastic mulch types (IRT-76, glossy black, and the biodegradables #19 and #131) were tested for durability and influence on pepper and slicing cucumber production. The total season yield of peppers was significantly higher in the IRT-76 treatment, however the other treatments did not improve yields. The yield response of cucumbers was much greater with the most significant increase occurring in IRT-76. Mulches #19 and #131 did not break down very well and still presented a removal and disposal problem at the end of the season.

Cauliflower curd induction trial

Five-week-old seedlings of three varieties, Siria, White Top and Andes were exposed to constant 5°C and 18°C temperatures for 2, 4, and 5 days prior to planting to evaluate the effects of temperature induction on cauliflower curd development. The results were not clear, however the 5° treatment appeared to cause earlier curd induction.

Cauliflower harvest prediction trial

Data gathered on 21 varieties transplanted and direct seeded were used to develop a harvest prediction model. The model uses the mean day temperature accumulation over the entire growing period to effectively predict when a variety is expected to mature. The model should assist producers in crop scheduling to provide continuous supplies for fresh market. The model will be refined in 1991.

Extension and Service Activities

One-to-one, on-farm extension service was provided to growers in the southern region of the province. Specialized equipment was loaned to growers to encourage adoption of new technology. Popular items included precision drills, transplanters and plasticulture equipment. Program staff provide the Stanhay precision drill seed belt punching and calibration service for producers who use Stanhay belt seeders. Growers seed lots are matched with the best combination of belt hole size and number of holes to ensure optimum plant density in the field.

Seminars for vegetable growers were given to provide variety recommendations and guidelines to data interpretation as reported in the ASCHRC Pamphlets 90-4 and 90-5.

The Processing Vegetable Growers Newsletter and Market Gardeners Newsletter were produced throughout the year. Numerous talks to amateur gardening groups were also given.

FRUIT CROPS PROGRAM

Program Leader: L. Hausher
Technologist: P. Pih

The Fruit Crops Program serves the expanding berry and bush fruit industry in Alberta through applied research, development, and extension activities. Strawberries, raspberries, and saskatoons are the main crops studied, although other fruit crops are being evaluated for their commercial potential. Extension and development activities are directed to producers and producer organizations like the Alberta Market Gardeners Association and Fruit Growers Society of Alberta.

Research Projects

Details on cultivar evaluation and cultural trials are reported in ASCHRC Pamphlet 91-6, 1990 *Fruit Crop Trials*.[1]

Strawberries

Evaluation of Junebearing strawberries for yield and winter hardiness

Sixteen named cultivars and seven numbered selections of strawberries were established in replicated blocks in 1987. Third-year production was markedly lower than in the first two years of production. The cultivars Kent and Glooscap continued to be the top producers.

Evaluation of winter protection of Junebearing strawberries

Replicated trials were established in 1987 to evaluate the effectiveness, as winter protection, of clear polyethylene mulch, and polyethylene in combination with straw. Straw mulch and no mulch were used as treatments for comparison.

Although the polyethylene mulch treatment provided top yields in the first two years, the straw mulch standard outyielded remaining treatments in the third production season.

Winter protection of Junebearing strawberries with polypropylene row covers

Single-row trials were established in 1989 to evaluate the effectiveness of polypropylene row covers as overwintering protection for Junebearing strawberries. A number of combination treatments using fibre and straw were evaluated on the cultivars Kent and Glooscap.

First year results indicated that yield increases may be induced with a combination of fibre and straw winter covering.

Junebearing strawberry evaluation

A new non-replicated trial was established in 1990 to evaluate winter hardiness, quality and yield of 24 Junebearing strawberry cultivars. Included

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[1]Note: This trial report also includes results of strawberry, raspberry and saskatoon trials conducted at Alberta Tree Nursery and Horticulture Centre, Edmonton.

in this trial are a number of cultivars from Nova Scotia, Ontario, B.C., Washington and California.

Evaluation of day-neutral strawberry cultivars

Four day-neutral cultivars were planted in a non-replicated evaluation. Plants were deblossomed for six weeks and derunnered for the season. They were harvested from June 25 to October 1. The cultivar Tristar produced 26.7 tonnes/hectare.

Evaluation of overwintered day-neutral strawberry cultivars

Day-neutral strawberries that were planted in 1988 and 1989, and harvested in subsequent years were overwintered under straw mulch. Upon resumption of growth in the spring of 1990, one-half of each row was deblossomed until June 1. The cultivar Tristar produced the highest marketable yield in the second and third year of production. Deblossoming did not affect yield.

Effects of deblossoming and derunnering on yield of day-neutral cultivars

Single rows of the cultivars Fern and Tristar day-neutrals were planted on April 19. Treatments included deblossoming plants for six weeks, derunnering plants for the season, and combinations thereof. The cultivar Fern responded positively to derunnering treatments. The cultivar Tristar did not respond to any of the treatments.

Effects of row covers on day-neutral strawberry production

Single rows of the cultivars Fern and Tristar day-neutral strawberries were covered with polypropylene row covers at planting on April 19. The row covers were removed at weekly intervals starting at 3 weeks after planting and ending 7 weeks after planting. Yields of Fern were highest when the row covers were removed 3 and 4 weeks after planting. There appeared to be no consistent relationship between timing of mulch removal and yield of Tristar, although all treatments with a minimum of 4 weeks cover did increase yields.

Effects of mulch and row cover treatments on yield of day-neutral strawberries

Single rows of Fern and Tristar day-neutral strawberries were planted on April 19, through three colours of polyethylene mulch, covered with a polyethylene (clear) tunnel or a spun-bond fibre product. Straw mulch was also used in addition to the synthetic mulches.

The clear mulch treatment, in which straw was applied over the mulch on May 15, and the polyethylene tunnel treatment produced higher yields of Fern than the other treatments.

Tristar produced the highest yields in rows covered with clear tunnel until May 15.

Raspberries

Evaluation of summer fruiting raspberry cultivars

Thirteen cultivars and ten advanced selections of summer-fruiting raspberries were established in 1987 in a randomized replicated planting. Due to severe winterkill very little fruit production occurred in 1990 and data were not analyzed.

Evaluation of primocane raspberry selections

Three primocane raspberry selections from Morden, Manitoba, and the cultivar Fallbrook were established in 1987. Plants were harvested in 1988 and 1989 and mowed to the ground each fall. Fallbrook had the highest yield in 1990.

Evaluation of primocane raspberry cultivars

Five cultivars of fallbearing raspberries were established in 1990 in a randomized replicated trial as part of the North American Primocane fruiting raspberry genotype by environment (GxE) study.

Saskatoons

Saskatoon cultivar evaluation

Ten cultivars established in 1988 in a randomized, replicated trial grew well in 1990. Growth characteristic records were taken. Plants will commence fruiting in 1991.

Saskatoon plant stock evaluation

A replicated trial was established in 1988 to evaluate types of plant stock of Smoky and Northline saskatoons. Data recorded during the fall of 1990 included plant height, number and height of suckers. Plant materials studied

were established from seed, taken from plant suckers, or propagated clonally via tissue culture. Fruiting should commence in 1991.

Extension and Service Activities

Fruit Facts, a newsletter directed to producers, was published monthly. Articles were prepared regularly for Alberta Market Gardeners Association (AMGA) and Fruit Growers Society of Alberta newsletters. Two berry production schools were conducted for commercial growers, and a research field day was held. Assistance was given to the AMGA in the bulk ordering of strawberry plants for Alberta producers.

The fruit specialist continued as secretary of the Alberta Professional Horticultural Growers Congress and Foundation Society, Alberta Horticultural Congress and Trade Show and the Alberta Market Gardeners Association. The North West Territories government was assisted with on-site planning and recommendations in establishing demonstration research projects. Presentations were made to research, commodity, and advisory groups during the year.

NURSERY CROPS & ORNAMENTALS PROGRAM

Program Leader: M. Robertson
Technologist: N. Seymour

The Nursery Crops and Ornamentals program serves Alberta's nursery and landscape industries. Research, extension, and the care of two large plant collections are the major elements of the program. From January until mid-June 1990, the scientist's position was vacant. During this period the nursery crops technologist managed the program.

Research Projects

Field Evaluation Trials

Prairie regional trials

Established in 1958, the Prairie Regional Trials test the hardiness of woody perennials on the Canadian Prairies. The Agriculture Canada Research

Station in Morden, Manitoba, is responsible for supervising the project and supplying the plant material. Brooks was one of the four original sites and remains one of eight sites involved in the tests today.

Regional woody plant test program

This ongoing cooperative trial between Landscape Alberta Nursery Trades Association (LANTA) and Alberta Agriculture complements the Prairie Regional Trials. Trees and shrubs are tested for five years at eight sites that represent the variety of climatic conditions in Alberta. Staff from the Alberta Tree Nursery & Horticultural Centre and the ASCHRC evaluates this material.

The University of British Columbia plant introduction scheme

Participation in this program is under the direction of B. MacDonald at U.B.C. Its aim is to introduce new cultivars and species to Alberta.

All America Selections

All America Selections is a non-profit organization dedicated to promoting the development and introduction of improved varieties of flowers and vegetables. The ASCHRC is one of approximately 35 flower trial sites in North America.

Experimental Research

The recent changes in the scientist's position caused some disruption to this part of the program. Most experimental research projects are new and still in the early stages.

Cold tolerance in Tower poplar

In some years, this highly desirable hybrid suffers considerable winter damage in Alberta. Tests are under way to determine the cause of winter damage. Freezing experiments revealed that Tower can tolerate extreme cold — down to -70 C° — but that damage can occur at much higher temperatures. These preliminary results suggest incomplete hardening or rapid dehardening during winter warm spells as possible causes of winter damage in Tower.

Artificial hardening studies

Nursery stock can be forced to grow late into the season, but this practice often results in incomplete hardening. A treatment that would quickly and effectively harden actively growing material would allow nurserymen to extend their growing season without increasing the risk of winter kill. Supplying plant hormones at critical times can trigger hardening events. This study will explore the use of natural and synthetic plant growth regulators as a means of rapidly hardening tender growth.

Hardening juvenile material

Some trees and shrubs are susceptible to winter damage during the juvenile phase of development but tolerant once they reach maturity. The aim of this experiment is to find ways of increasing the hardiness of these plants in the juvenile phase.

Salinity and cold tolerance of ornamental trees

This experiment is designed to determine the effects of salt stress on the hardiness of woody ornamental plants. This is a cooperative program under the direction of C. McKenzie, the soil and water specialist.

Cold tolerance in roots

Little work has been done on the tolerance of roots to cold. Roots normally grow in a protected environment and are not exposed to extremely low temperatures. However, with the advent of container growing, the question of cold tolerance in roots becomes an important consideration for overwintering container-grown nursery stock. Work on this program to date has focused on the use of abscisic acid and its synthetic analogues as treatments to promote root hardening.

Apical dominance studies

This is a long-term cooperative study with Agriculture Canada and the University of Calgary. Initially, the project will focus on the hormonal factors that control apical dominance and the related phenomena of bud dormancy, growth inhibition, and cold hardening. Rapid changes in abscisic acid levels in the axillary buds, following release from apical dominance, suggest that this hormone is involved in the maintenance of bud dormancy. Results from this study could have major implications for cold hardiness studies.

Mulching and soil amendment studies

Establishing even hardy material in dry land sites (*i.e.* not irrigated) can be difficult. Various mulching and soil amendment treatments will be used to try to improve the soil-water relations and thereby the survival rate in transplanted material. This is a joint project with J. Carrington of Public Works.

Extension Services

Extension services focus primarily on the landscaping and nursery industries. Other interests such as golf courses and city parks also utilize the services. The specialist also handles calls from the general public when the seasonal information officer is unavailable.

Reference Collections

Two large demonstration plots serve as reference collections for researchers, industry, and the public.

The Golden Prairie Arboretum

Established in 1985, the Golden Prairie Arboretum contains over 500 specimens, each representing a different species or cultivar of broadleaf woody plant. The collection includes most of the deciduous trees and shrubs that can be grown on the prairies.

The Forever Green Pinetum

This special collection of coniferous plants was established in 1988. It complements the Golden Prairie Arboretum.

GREENHOUSE CROPS PROGRAM

Program Leader: J. Butt
Technologist: M. Briant

The greenhouse crops program serves southern Alberta's greenhouse vegetable and floriculture industry by providing a comprehensive extension service and conducting applied greenhouse research. Extension services include crop

management information, diagnosis of crop disorders, and soil and tissue test interpretations.

Research Projects

Vegetable Crops

Effect of silicates on the control of powdery mildew in greenhouse cucumbers

To evaluate the effect of potassium and sodium silicates on powdery mildew (*Erisyphe cichoracearum*) infection in long English seedless cucumbers, three rates (100, 200, and 400 ppm) of silica (SiO_2) were applied three times per week to both spring- and fall-grown crops of Corona cucumber in rockwool. Plants were inoculated with powdery mildew and disease severity ratings were conducted periodically. Yield and grade-out were recorded three times per week.

Greenhouse cherry tomato cultivar trial

Cherry tomato cultivars, Sweet 100, Evita, Cherita, Cherry Wonder and Sweetie were evaluated for yield and quality and compared to a beefsteak cultivar Caruso. Cherry tomatoes are typically more labour-intensive than beefsteak tomatoes due to greater pruning and harvesting requirements. In order to determine if labour required to manage the cherry tomato crop could be reduced, plants were pollinated either two or three times per week. Caruso was pollinated three times per week. Yield and fruit size were recorded twice per week. Reduced frequency of pollination did not affect the yield. Caruso outyielded all cherry tomato cultivars on the basis of weight. Evita and Cherry Wonder produced the greatest number of fruit and among the cherry tomato cultivars they were also the high yielding cultivars. The greatest number and weight of culls were found in Caruso.

A sensory evaluation was completed by 15 panellists, who ranked the fruit for the following characteristics: appearance and size, skin and flesh colour, skin and flesh texture, and flavour. Sweet 100 was the preferred cultivar in the sensory evaluation.

DRIS nutrients analysis of greenhouse cucumbers

Twenty southern Alberta growers provided cucumber leaf samples, growing media and nutrient solution samples on a bi-weekly basis from April to July. Samples were analyzed for all nutrients by the Soils and Animal Nutrition Lab.

Results will be analyzed according to Diagnosis and Recommendation Integrated System (DRIS) guidelines.

Evaluation of day-neutral strawberries as a fall and winter greenhouse crop

Day-neutral strawberry plants (cultivars Tristar and Hecker) were dug from field plots in September 1989 and transplanted into grow-bags. One-half of the plants received high pressure sodium supplemental lighting during the daylight hours. Plants were either derunnered or allowed to runner. Derunnering did not affect yield in either cultivar. Supplemental lighting increased the number and weight of marketable berries of Hecker but not Tristar.

Floriculture Crops

Soil cooling of freesias

Freesia corms of the cultivars Uchida, Marianne, Cordula, and Athene were planted in April in ground beds that were either kept at ambient soil temperatures or cooled to 13-15°C. All beds remained at ambient soil temperatures for four weeks following planting to allow for adequate vegetative growth. Cooled beds were then maintained at 15°C for four weeks during flower initiation and 13-15°C thereafter. Ambient bed temperatures were 17-22°C throughout the trial. The number of flower stems, flower buds, and stem length were recorded daily. The time to flowering in Uchida and Cordula was decreased by 2-3 weeks with soil cooling and the number of flowering stems of all cultivars was greater than in the ambient temperature beds.

Lisianthus as a cut flower or pot crop

Lisianthus was grown as a cut flower with three seedlings per 15-cm pot. Seedlings were either unpinched, pinched at the third node, or pinched at the sixth node. The number of lower stems, flower stem length, and date of flowering were recorded.

To evaluate the suitability of Lisianthus as a pot crop, seedlings were planted in 10-cm or 15-cm pots and either unpinched, pinched at the third node, or pinched at the sixth node. Half of the pinched and unpinched plants were treated with a growth regulator. The overall appearance, number of flowering stems, and plant height were recorded.

Uneven and delayed flowering in both the potted and cut flowers led to early termination of the trial.

DIF temperature manipulation for poinsettia height control

To evaluate the effect of cool day temperatures and warm night temperatures on height, poinsettia cultivar Annette Hegg Dark Red was grown in growth chambers at the following temperatures: 20°C day, 20°C night; 16°C day, 20°C night; 16°C (7-10 am), then 20°C day, 20°C night. All plants were grown at 20°C day/20°C night until September 30 when the treatments were initiated. Growth chamber light conditions were programmed to mimic prevailing greenhouse light conditions. Plant height, bract diameter and number of bracts were recorded.

DIF temperature manipulation for bedding plant height control

Similar temperature treatments, as outlined above, were applied to petunias, geraniums and carnations. Plant height, time to flowering and dry weight were measured.

Evaluation of Sumagic growth regulator for height control in poinsettias

The poinsettia cultivar Annette Hegg Dark Red was treated with Sumagic sprays or drenches: 2.5 ppm spray in one, two or three applications; 5.0 ppm in one or two applications; 0.25 ppm drench in one, two or three applications; 1.0 ppm drench in one or two applications. Plant height, bract diameter, bract number and time to flowering were measured.

Extension

A large component of the 1990 greenhouse program involved extension to southern Alberta greenhouse growers. This consisted of about three days each week for greenhouse visits, one day for the research component, and one day for office calls and correspondence.

The greenhouse specialist was also the associate director of the Alberta Greenhouse Growers Association and secretary of the Protected Crops Advisory Committee. Assistance to the greenhouse industry, in the form of workshops, meetings, industry tours and surveys, was also provided.

SPECIAL CROPS AND AGRONOMY SECTION

This section conducts applied research and provides extension and development services for special crops such as pulse crops, field corn, herb and spice crops, sunflower, and other new crops (for the primary purpose of crop diversification). The section is also responsible for forage, cereal and oilseed cultivar testing and forage agronomy. The relationship of water and soil management to crop productivity is also researched. Research and extension projects are conducted cooperatively with numerous other agencies. Most of the field trials are conducted on the Macleod Farm at Brooks, at the substation at Bow Island, and in farmers' fields at Rolling Hills, Standard, Acadia Valley, Milk River, Carmangay, Millicent, Hanna, and Bow Island.

Section Administration and Special Crops

Refe Gaudiel, B.S.A., M.Sc., Ph.D. . Section Head & Research Agronomist
Collin Wildschut, Dipl. Hort. ..... Technologist
Pat Moskaluk ..... Secretary

Field Crops

Henry G. Najda, B.Sc., M.Sc., P.Ag. ..... Research Agronomist
Art Kruger ..... Technologist

Soil and Water Agronomy

R. Colin McKenzie, B.S.A., M.Sc., Ph.D., P.Ag. .... Research Agronomist
Neil Clark, Dipl. RRT ..... Technologist

SPECIAL CROPS PROGRAM

Program Leader: R. Gaudiel
Technologist: C. Wildschut

The Special Crops Program is responsible for applied research, extension, and development work on alternative crops and crops new to Alberta. The program also provides service to other departmental staff and commodity organizations as consultants and through cooperative tests and demonstration plots.

Detailed project results are presented in ASCHRC pamphlet 91-20, *Special Crops Cultivar Trials.*

Research Projects

Evaluation of Cultivars and Cultural Practices for Drybeans

Fifteen screening and yield tests were conducted at Brooks and Bow Island, under irrigated conditions, to evaluate the performance of various cultivars, selections, and breeding lines of drybeans. The Drybean Prairie Cooperative Test is used to gather data for varietal registration; the Drybean Advanced Test for varietal recommendation; and the U. S. Cooperative Nursery and numerous other observational tests for screening purposes. We observed several experimental lines of different bean types that were earlier and yielded better than the standard cultivars. In addition, several lines that were upright, tall, and narrow in growth habit (archetype) were also relatively early maturing. In 1990, four cultivars were recommended for registration of which three were brought forward by the sponsor and subsequently registered.

A foliar fertilization test was continued at Bow Island to determine the effects of spraying different kinds and formulations of chemical fertilizers on the foliage of two drybean cultivars. Foliar application of most of the commercially available soluble macro- and micronutrients, either once or twice in the growing season, did not appear to increase the yield of pinto drybean.

Several cultivars of archetype drybeans were again grown at different row spacings to evaluate these cultivars at higher populations and their feasibility for direct harvest. Some cultivars appeared to have the potential for high density planting and direct harvesting.

A crop modelling study was initiated as part of an international program to develop a computer model for growth, development and yield in relation to various environmental parameters. Phenological traits of seven bean cultivars were observed in addition to other agronomic and growth characteristics.

Evaluation of Cultivars and Cultural Practices for Other Pulse Crops

Cultivars and breeding lines of fieldpeas, lentils, fababeans, soybeans, lathyrus, lupins, and chickpeas, and were again evaluated at Brooks, Bow Island, Standard, and Acadia Valley. The tests at Acadia Valley were conducted by CARA.

The fieldpea observational, co-operative, and regional tests showed a number of breeding lines and cultivars that were early and high yielding. The observational tests are used for preliminary screening, the cooperative test for registration, and the regional test for recommendation. Several European cultivars were semi-leafless, erect, early maturing, and yielded as well or better than the standard cultivars.

Several fieldpea cultivars were seeded on different dates at Brooks to determine the effect on yield. Plants seeded in early and mid-May appeared to yield better than those planted in late May. Several fieldpea cultivars were also planted at different seeding rates and under different amounts of irrigation to evaluate varietal response to plant population under different soil moisture conditions.

A promising lentil line tested under both dryland and irrigated conditions was one similar in size to the common Chilean. This line may be available for registration in the near future and will fill the market need for a lentil that is intermediate between the small-seeded Eston and the large-seeded Laird.

Evaluation of fababean lines continued at Brooks in 1990. Certain determinate fababean cultivars from Europe yielded well and were early enough to mature in 1990.

No outstanding line of soybeans was observed. Evaluation of natto-type soybeans was not completed because of poor plant stand. A few selections of lathyrus, low in neuro-toxic factor, proved early and comparable in yield to the old standard cultivars. The lupins evaluated at Bow Island reached maturity and showed promise. The desi-type chickpeas appear to be better adapted to Alberta than the kabuli types.

Evaluation of Cultivars and Cultural Practices of Other Special Crops

Cultivars and lines of safflower, canary seed, millet, fenugreek, quinoa, grain amaranth, Jerusalem artichoke, and hybrid sunflower were evaluated at Brooks, Bow Island, Standard, and Acadia Valley. A few safflower lines were comparable in maturity and yield yet higher in oil content than the standard cultivar, Saffire. No new experimental lines of canary seed or millet were outstanding. Only one irrigated test of confectionery sunflower was harvested because of severe bird damage to the other trials. No new outstanding sunflower hybrid was noted. The selections C0407 and C0407-12 from Colorado State University appeared to be the only quinoa entries adapted to Alberta. A few of the grain amaranth lines reached maturity and appeared better suited to Alberta than quinoa.

Safflower seeding rate tests at three different soil moisture levels, and a seeding date test, were conducted at Brooks. The later seeded plants appeared to yield as well as the earlier seeded plants. Varying the seeding rates did not seem to affect the yield of Saffire safflower grown under dryland, partial irrigation, or full irrigation conditions.

Adaptability, Cultivar Evaluation, and Agronomic Studies of Herb and Spice Crops

The objective of this project, funded by the Farming for the Future program, was to determine crop adaptability, basic agronomic practices, and potential yields of over 100 annual and perennial crops and cultivars. Seeding and harvesting dates, seeding rates, row spacing and seeding depth trials were conducted. Large plots of several promising crops plus large commercial fields of a few selected spice and essential oil crops were again established to gather economic yield and quality information.

The adaptability trials showed that seed crops such as coriander, caraway, dill, fenugreek, lovage, and perhaps even borage and anise can be grown successfully in Alberta. Herbs such as the basils, cilantro, summer savory, the bergamots, artemisia, chamomile, sage, chives, tarragon, parsley, and the mints can potentially be grown in Alberta. Our screening trials also identified better lines or selections of basil, coriander/cilantro, dill and fenugreek.

The agronomic trials, conducted in small experimental and large commercial sized plots, have identified most of the basic management practices that are necessary for the production of caraway, coriander, peppermint, spearmint, monarda, basils, and lemon bergamot. Numerous distillation tests using small laboratory, pilot size, and commercial units have also provided information on the extraction of essential oil from these crops. Yields and quality determinations have shown potential for the production and marketing of these crops.

Corn Hybrid Trials

Hybrid tests of grain and silage corn were conducted at Brooks and Bow Island as part of the Alberta Corn Hybrid Testing Program sponsored by the Alberta Corn Committee. Combined results of all the tests are used to recommend hybrids for registration and to make recommendations to Alberta growers. Approximately 33 silage and 22 grain hybrids were evaluated.

The Bow Island site was severely wind blown when crops were in the early seedling stage resulting in a poor stand and the site had to be discarded. Most hybrids reached maturity because of favourable dry weather from the first week of August until the occurrence of a killing frost late in September. Several grain hybrids were earlier in maturity and as good or better in yield than the standard hybrids. These early hybrids offer the potential of extending the area in which corn can be grown and will further reduce the risk of frost damage in areas where corn is being grown now.

Detailed results are presented in the Alberta Corn Committee publication *Hybrid Trials - 1990.*

FIELD CROPS PROGRAM

Program Leader: H. Najda
Technologist: A. Kruger

The Field Crops Program conducts research on traditional cereal, oilseed, and forage crops to provide up-to-date information and to investigate non-traditional uses of these crops as options for the producer.

Four major projects involving over 90 trials were conducted at various locations in southern Alberta. The main testing site is at the Brooks; other sites are

located at the Substation in Bow Island, and near Standard. These are all irrigated sites.

Several trials were conducted in cooperation with other research institutions and agencies. These include Agriculture Canada Research Stations at Lacombe (annual forages) and Swift Current (triticale), and the Field Crops Branch, Alberta Agriculture (cereals, oilseeds and forages). We assist the Chinook Applied Research Association (CARA) in cereal, forage, and special crops research. New crop varieties are also tested for universities and research agencies in Canada and abroad.

The Field Crops Specialist provides service to other Alberta Agriculture staff and to producer and commodity organizations. Details of all research trials are presented in *Field Crops Cultural and Cultivar Trials, 1990*, ASCHRC Pamphlet 91-9.

Research Projects

Cereal and Oilseed Cultivar Evaluation

Cereal and Oilseed Regional Tests

Trials coordinated by the Field Crops Branch of Alberta Agriculture at Lacombe were used to evaluate all recommended varieties, new varieties, and breeding lines of hard red spring wheat, durum wheat, utility wheat, barley, oats, triticale, flax, and canola. The ASCHRC is responsible for the three irrigated sites at Brooks, Bow Island and Standard. Information from these trials, conducted at more than 30 sites province-wide, is used by the Cereal and Oilseed Advisory Committee to update its recommendations. The committee annually produces a factsheet entitled *Varieties of Cereal and Oilseed Crops for Alberta*.

New varieties registered in 1989 and 1990 that had been tested in the program include: barley - AC Stacey, Creme, Duel, Tankard, and Bridge; wheat - Biggar and SWS 152; and canola - AC Parkland, Delta, and Stallion.

Other Cereal Trials

The ASCHRC cooperates with the Field Crops Branch in their breeding programs for 2-row and 6-row barley, triticale, winter triticale, and winter wheat. The progeny and advanced line tests provide agronomic data that are

used in the selection process for determining new varieties suitable for irrigated areas. Triticale grain trials are conducted under the Prairie Registration Recommending Committee on Grain testing program, which is coordinated by the Agriculture Canada Research Station at Swift Current, Saskatchewan.

Annual Forage Crop Studies

Silage trials

In 1990, several cultivar trials were conducted on annual forages used as silage. These included barley, oats, utility wheat, triticale, field pea, fababean, and forage sorghum. This was the fourth year of testing and the results will provide a database on variety performance for making recommendations. Yield and quality were high for all species because of the excellent growing conditions during critical growth stages.

Of the 2-row barley varieties, Klages had the highest yield over 4 years. Of the 6-row barley varieties, Argyle had the highest yield; 27% better than the check variety Galt. Wapiti was the best yielding triticale. Fielder was the best silage producer among utility wheats over 4 years of testing. Riel was the highest producing oat variety in 1990 with a yield of 10,425 kg/ha. Aladin was the highest yielding of the registered fababean varieties tested. The highest yielding sorghum-sudangrass and forage sorghum hybrids, under irrigation at Brooks, Bow Island, and Standard were Sudax ST-6B and Pioneer 931, respectively.

Cultural studies

Research continued on the inter-cropping (seeding at the same time) of spring and winter cereals for silage, hay, or pasture. Information on the time of harvesting the spring cereal relative to its growth and development has provided several preliminary management options for using intercropped annual forages. Part of this study, done in cooperation with V. Baron (Agriculture Canada) and D. Salmon (Alberta Agriculture) both of Lacombe, was presented at the 82nd annual meeting of the American Society of Agronomy held in San Antonio, Texas.

In another study, the possibility of increasing yield and quality of cereal silage crops and annual pasture by intercropping with annual legumes was

examined. Preliminary results were encouraging and the experiment will be expanded for further investigation.

Perennial Forage Crop Studies

Perennial forage variety testing

This was the first year of a new province-wide program evaluating perennial forage varieties. The ASCHRC will be responsible for conducting trials at two dryland and two irrigated sites and for compiling data from all sites, analyses, and preparing the annual report. This program was initiated to provide data to support recommendations that would allow producers to select the newest forage varieties available.

Perennial forage seed production

In 1989, three trials were initiated to investigate the economics of producing grass seed under irrigation and to determine fertilizer requirements of Kentucky bluegrass, tall fescue, and perennial ryegrass. These grasses were chosen because of their market potential for turf and pasture. This is a co-operative project with R. C. McKenzie, the soil & water specialist, and K. Miller, a seed producer at Milk River. First-year results were encouraging with seed yields averaging over 1100 kg/ha in the perennial ryegrass and tall fescue trials, and with bluegrass yields at about 800 kg/ha.

Extension and Service Activities

Presentations were made by the field crops specialist at one major scientific conference, several industry and producer meetings, and provincial advisory committees. Two scientific reports were written as well as several articles for producer magazines.

The program leader served as president of the Southeast Branch of the Alberta Institute of Agrologists, as a member of the Agriculture Technology Advisory Committee of the Lethbridge Community College, and as a seed judge for the North American Seed Fair held at Ag-Expo, Lethbridge.

SOIL AND WATER AGRONOMY PROGRAM

Program Leader: C. McKenzie
Technologist: N. Clark

The Soil and Water Agronomy Program conducts research and provides expert advisory services in soil and water management for special and horticultural crops, and on water use for irrigated crops. This includes all aspects of soil and water management: fertilizer use, water use efficiency, salinity tolerance, and tillage. Alberta Agriculture's Soil and Animal Nutrition Laboratory in Edmonton supports this program by providing laboratory analysis of soil and plant samples.

Research Projects

Irrigation Management of Lentils

Yield data were collected for 4 years on two lentil cultivars, Eston (early maturing, small-seeded) and Laird (late maturing, large-seeded), grown under four irrigation treatments. The highest water uses were recorded in 1988 at a site surrounded by non-irrigated fallow, where evapotranspiration was high because of the lack of adjacent transpiring foliage. Laird showed an appreciable decline in yield when water use was higher than optimum (190-270 mm). Laird is an variety with indeterminate growth and when ample water is available it continues to grow vegetatively and fails to set seed. Eston, a variety with determinate growth, did not respond significantly to varying amounts of irrigation provided. Maximum yields of Eston were obtained with from 250 to 470 mm of water.

The protein content of lentils was not reduced by increasing the frequency of irrigation and, in some cases, it increased. In previous experiments, the protein content of other pulses such as fababeans and peas responded similarly. This is different from cereals, forages, and vegetables in which protein content declines with increasing amounts of irrigation.

Irrigation Management of Safflower

Saffire safflower was grown under four irrigation treatments and three nitrogen treatments at Bow Island. The irrigation treatments were W0 - no irrigation, W1 - one large irrigation, W2 and W3 with irrigation to maintain the

soil at 50 and 70% of field capacity, respectively, in a 1.20-m root zone. The W2 irrigation treatment produced the highest seed yields at 3.38 t/ha and the control produced the lowest at 2.82 t/ha. The nitrogen treatments N1, N2, and N3 provided 79, 148, and 215 kg/ha soil + fertilizer N, respectively. Nitrogen fertilizer increased the seed yield significantly. Oil content will be determined on seed samples from all treatments.

Depletion of available water to 2.40 m was measured on all treatments. It was significantly related to irrigation level and rate of nitrogen applied and ranged from 154 mm on W0 to 84 mm on W3, and from 140 mm on N3 to 109 mm on N1. This is the third year of this project but it is the first year water use was measured on nitrogen treatments.

Irrigation Management of Alfalfa

Two cultivars of alfalfa, Apica (Flemish type) and Barrier (standard type), were grown at Rolling Hills under intensive management. The effect of three cutting and four irrigation regimes on yield, quality of foliage, and survival of the stand will be measured. Harvests were first taken in 1990. Irrigation treatments in 1990 varied from 257 to 652 mm. Yields on the different irrigation and harvest treatments varied from 9.6 to 13.7 t/ha. The increase in dry matter yield obtained with more irrigation and increasing the number of harvests was 43%. Protein yield increased 79%. This is important if high protein alfalfa is needed for export markets. Depletion of available moisture was 195 mm more on the lowest irrigation treatment as compared with the highest irrigation treatment. Further investigation will be required to establish the effect of the different treatments on yield and survival of the stand.

Nitrogen Fertilizer Requirements of Grasses Grown for Seed

In 1989 a joint project was initiated with K. Miller, a forage seed producer at Milk River, M. Nakonechny, Alberta Forage Seed Council, and H. Najda, field crops agronomist. It received financial support from the Canada New Crop Development Fund. The effects of two dates and four rates of nitrogen fertilizer application on the seed production of perennial ryegrass, tall fescue, and Kentucky bluegrass were measured. Seed was harvested in 1991. Tall fescue and perennial ryegrass under the nitrogen treatments yielded better than the control but the increases were not statistically significant; average yields

were 1136 and 1159 kg/ha, respectively. Because Kentucky bluegrass yields were variable, the experimental site has been moved for 1991. The project will continue for two more years; treatments with two dates of application of potassium fertilizer will be added with Kentucky bluegrass.

DRIS Tissue Analysis

The Diagnostic Recommendation Integrated System (DRIS) system was developed in southern U.S.A. and South Africa in the 1970s and is suited for use with intensively managed crops. DRIS uses nutrient ratios rather than nutrient sufficiency levels to determine nutrient deficiencies. Nutrient ratios are less dependent upon stage of maturity than nutrient sufficiency levels.

Tissue samples were collected and yields were determined on a number of crops to collect data to develop DRIS standards and to survey the nutrition status of crops. Twenty three alfalfa fields were sampled in 1989, and 10 in 1990. Soil and tissue phosphorus levels were often found to be low and, in some cases, levels of potassium in tissue were marginal. Tissue and soil phosphorous levels and age of the stand were directly related to yield of alfalfa. When more data has been accumulated, DRIS analysis will be done by L. Kryzanowski of the Soils Branch.

A total of 20 fields of grain and silage corn were sampled at the end of July for tissue and soil analyses; grain and forage samples were taken in September to determine yield. In addition, samples of soil, nutrient medium, and tissue were collected from 16 greenhouse cucumber operations in the Medicine Hat and Redcliff area. The cucumbers were sampled every second week from March to July during 1990. When more data has been accumulated, soil and plant analyses will be related to yield of these crops.

Salinity and Cold Tolerance of Ornamental Trees

This project, funded by Farming for the Future, commenced in 1989 as a joint project with Nursery Crops and Ornamentals staff. Twenty seven species were planted in 1989; another was added in 1990. The species were replicated six or ten times in each of five salinity zones. The 15 species that were replicated 10 times will also be used for cold tolerance evaluation. Graphs have been prepared showing growth indices and mortality rates for each zone. Russian olive has shown good tolerance to salinity in four zones and moderate

tolerance in the fifth, most saline, zone. A number of species have shown good tolerance to salinity in the first three zones. Growth data for several years will be collected to determine the salinity tolerance of all the species. Mortality and replant data were recorded for all species. A field trial with a large number of species and replications is feasible because, with an EM38 meter and data logger, salinity data can be efficiently collected at a low cost. In early 1991, a preliminary cold tolerance evaluation will be done on cuttings taken from five species.

S. Woods, who has worked on this project for the past two summers, will be using data from this project for her thesis at the Faculty of Environmental Design, University of Calgary. Her thesis topic is "Urban and rural application for the salinity and cold tolerance of ornamental trees and shrubs in southern Alberta."

Salinity Tolerance of Turf and Forage Grasses under Irrigated and Dryland Conditions

This project was initiated in 1990 in cooperation with H. Najda, the field crops agronomist. Twenty six species or varieties of turf and forage grasses were grown under irrigated conditions at Millicent. Two more will be planted in 1991. Twenty species were planted under dryland conditions at Hanna and eighteen at Oyen. The 3-4 ha sites were chosen to provide a range of salinity values from low to very high. In 1991, forage samples will be harvested from about 40 locations from each species at each site to provide a range of salinity values. Salinity measurements will be taken with at the same sites where forage yields are recorded. The relationship between forage yield and salinity will be described by regression equations.

Rapid Mapping of Salinity Using an EM38 meter

Advice on use of an EM38 meter was provided to government agencies and consultants. Detailed maps were made of three salinity tolerance experimental sites. Assistance was provided to the University of Calgary, Survey Engineering Department, to develop a proposal to use a geographic positioning system to continuously record the location of an EM38 meter during salinity surveys. This method should provide a rapid economical means of mapping salinity.

Influence of Climatic Factors on Crop Production in East Central Alberta

This project is conducted by staff of the Chinook Applied Research Association (CARA) at Oyen. The Soil and Water Agronomy Program at Brooks provided soil sampling equipment and assisted with data analysis. The number of paired cereal forage sites sampled was nine in 1989 and eight in 1990. Linear correlations were made between wheat yield and precipitation, water use efficiency, and June temperatures. Similar correlations were calculated between forage yield and water use and temperature. The project is anticipated to continue for three more years.

Extension

Soil and water information was provided through technical and research publications. Presentations were made at producer meetings and enquiries were answered through telephone contacts, office visits, and correspondence.

CROP PROTECTION AND UTILIZATION SECTION

This section conducts research, extension and service programs in plant pathology, entomology, weed science, plant diagnostics, post-harvest technology, and food science. Support is provided to crop production research programs at ASCHRC and to agricultural industries and individual producers in Alberta. Crop pest surveys and diagnoses, pesticide efficacy testing, evaluation of produce storage practices, and modified atmosphere packaging food products are examples of some of the work carried out by section staff. Research and extension projects are done cooperatively with other ASCHRC staff and with federal, provincial and university scientists. Close working contacts are maintained with several agricultural and scientific organizations outside of Alberta.

Section Administration and Plant Pathology

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Weed Science

Rudolph Esau, B.S.A., M.Sc., P.Ag. ..... Weed Scientist
Bernice Kruger, Dipl. Agr. ..... Technologist

PLANT PATHOLOGY PROGRAM

Program Leader: R. Howard
Technician: E. Moskaluk

In 1990, the Plant Pathology Program conducted applied research on diseases of greenhouse, forage and special crops. These studies involved field, laboratory and greenhouse experiments, as well as disease surveys. Findings from this and other research were presented to producers through extension programs. Diagnostic assistance was provided to the Regional Crop Laboratory. Further details of all research trials appear in the *Plant Pathology Program Research Report - 1990*, ASCHRC Pamphlet 91-10.

Research Projects

Diseases of Special Crops

Efficacy of seed treatment against seed decay and seedling blight of safflower

Thiram 75% was evaluated for the efficacy against seed decay and seedling blight in field and growth chamber trials. It was applied to Saffire safflower seed at a rate of 2.0 g/kg. Replicated trials were planted with treated and untreated seed at field sites near Brooks, Bow Island, Lethbridge and Wrentham. Soils at these locations were naturally infested with *Pythium* spp., *Fusarium* spp., and other seedling blight organisms. Thiram appeared to improve plant stands relative to the untreated control at Brooks (8.6%) and Lethbridge (24.4%), but these increases were not statistically significant. Average seed yields from the Thiram-treated plots were higher at Brooks (2.0%), Lethbridge (13.9%) and Wrentham (8.1%), but a statistically significant increase was achieved only at Wrentham.

Thiram-treated and untreated seed was planted in pots of field soil collected from plots near Brooks, Bow Island, Lethbridge and Wrentham. The replicated experiment was conducted in growth chambers at the ASCHRC. Thiram significantly improved safflower emergence in all four soils. A 25-fold increase was seen in one instance.

Trial results were published in the *1990 Pest Management Research Report - Insects and Diseases* of the Expert Committee on Pest Management, Agriculture Canada, Ottawa.

Efficacy of five fungicides against powdery mildew on monarda

Five foliar-applied fungicides were evaluated for their ability to control powdery mildew (*Erysiphe cichoracearum*) on monarda (*Monarda fistulosa*), an essential oil crop, in field trials at the ASCHRC. Micro-Niasul WP (2.0 kg/ha), Funginex 6.5 EC (1.0 L/ha) and Bayleton 50 WP (0.5 kg/ha) were applied with a pressurized, hand-held boom sprayer. The plots had been mowed in mid-July and the regrowth was 25-30 cm tall and lightly infested with mildew at the time of fungicide application. Mildew severity was visually rated 4-5 weeks after spraying. Plants treated with Bayleton and Micro-Niasul were lightly infested with mildew and had significantly less disease than those in the check and Funginex-treated plots.

Trial results were published in the *1990 Pest Management Research Report - Insects and Diseases* of the Expert Committee on Pest Management, Agriculture Canada, Ottawa.

Screening dry beans for resistance to fusarium root rot

Forty-one named cultivars and breeding lines comprising the Prairie Dry Bean Co-op Trial were screened for resistance to *Fusarium oxysporum* in the field at ASCHRC. This trial was done in cooperation with G. Saindoin, Agriculture Canada, Lethbridge. The *Fusarium* fungus was introduced into the soil along with the seed at planting, and an uninoculated row of each entry was seeded alongside for comparison. Unfortunately, the incidence and severity of root rot were low and meaningful assessments of disease resistance were not possible.

Diseases of Forage Crops

Survey for diseases on forage grass seed crops

Twenty-three forage grass seed fields in southern Alberta were surveyed for diseases between June 26 and July 18. Each field was systematically examined for root, crown and foliage diseases. Thirteen types of forage grasses were surveyed: Altai and Russian wildrye, Kentucky bluegrass, orchardgrass, perennial ryegrass, tall fescue, meadow and smooth bromegrass, and crested, northern, pubescent, slender, and western wheatgrass. Nine of the fields were irrigated and fourteen were under dryland production. Most of the crops were headed out at the time the survey was done.

Physiological leaf scorch was the most prevalent disease; it occurred on all but western wheatgrass. Scattered dark brown spots were observed on the leaves and stems of several of the grasses. Although various species of fungi were isolated from these spots, their pathogenicity remains to be determined. The overall severity of these leaf and stem spot diseases was rated as slight. Incidence and severity of root and crown rots were also minor. Nodal discoloration, a disorder that was often associated with sterile heads ("whiteheads"), was observed on Kentucky bluegrass, meadow bromegrass and northern wheatgrass. Insect damage, presumably caused by grass-feeding plant bugs, was sometimes observed at or near the affected nodes. *Fusarium* spp. were frequently isolated from the nodes and from the shrivelled, discoloured ends of the seed stalks at a point on the stem just above the node. Head smut was the most serious infectious disease. It occurred on about 10% of the heads in a stand of Regar meadow bromegrass and in up to 50% of the heads in one field of slender wheatgrass.

The survey results were published in the 1991 Disease Highlights Edition of the *Canadian Plant Disease Survey*, Agriculture Canada, Ottawa.

Diseases of Greenhouse Crops

Efficacy of potassium silicate for the control of powdery mildew in European seedless cucumbers

Potassium silicate (K_2SiO_3, 25% LI) was applied to the roots of Corona cucumbers growing on rockwool slabs. Rates of 0, 100 and 200 ppm of silicon and application intervals of 1, 2, 3 and 4 weeks were tested. The plants were inoculated with the powdery mildew fungus *Erysiphe cichoracearum*, and disease severity was rated four times over the course of the experiment. Silicon did not significantly reduce mildew severity at any stage of the trial, nor did it increase the number or weight of marketable fruit relative to the untreated check.

Efficacy of film-forming polymers and sodium bicarbonate for the control of powdery mildew on European seedless cucumbers

Wilt Pruf, Foli-Gard and Cow Brand baking soda were applied to the leaves of Corona cucumbers to assess their ability to control powdery mildew. Each product was applied at two concentrations in mixtures with water. For comparison, Micro-Niasul, a fungicide commonly used for mildew control in commer-

cial greenhouses, and tapwater alone were sprayed onto other plants. Mildew incidence and severity were not significantly reduced by Wilt Pruf, Foli-Gard or baking soda relative to the control. Only Micro-Niasul provided significant control of the disease.

Survey for zucchini yellow mosaic in greenhouse cucumbers

Five greenhouses in Redcliff were surveyed for zucchini yellow mosaic, a new virus disease of greenhouse cucumbers in Alberta. The disease was confirmed in four of the operations. C. Hiruki, University of Alberta, Edmonton, and R. Stace-Smith, Agriculture Canada, Vancouver, assisted with identification of the virus.

Extension and Service Activities

The plant pathologist spoke at several growers' meetings and workshops and was involved in the activities of several professional societies and advisory committees. Regular contributions were made to the *Crop Protection Newsletter*. One scientific paper and a number of miscellaneous publications were prepared.

Considerable time was spent editing and writing material for the book *Diseases and Pests of Vegetable Crops in Canada*, a joint publication of the Canadian Phytopathological Society and the Entomological Society of Canada. It is scheduled to be published in 1991.

The **Fungicide and Fumigant Information Retrieval System (FFIRS)**, a microcomputer-based program for obtaining information from fungicide and fumigant labels, was upgraded by C. Bone. Efforts to formally register this software with Alberta Agriculture continue.

FOOD PROCESSING AND QUALITY EVALUATION PROGRAM

Program Leader: J. Panford
Technicians: M. Dench and J. Hung

The objectives of the Food Processing and Quality Evaluation Program (FPQEP) are threefold:

- to develop methods and standards for modified atmosphere packaging and controlled atmosphere storage of horticultural crops grown in Alberta;
- to plan, develop and conduct sensory and chemical analyses, and processing of horticultural and special crops grown at ASCHRC, and
- to provide extension and technical assistance to producers, processors and others in the agri-food sector.

Research Projects

Modified Atmosphere Packaging

Modified Atmosphere Packaging (MAP) involves packaging foods in altered gas atmospheres that are designed to extend shelf-life and retain quality. The basic steps in a MAP operation are wrapping produce in a plastic film (bag), removing the air, introducing the mixed gas and sealing the package. Application of MAP technology to fruits and vegetables is more complex than it is for many other products, because these products are actively respiring, *i.e.* consuming O_2 and producing CO_2. Consequently, achieving a useful atmosphere for fruits/vegetables involves balancing respiration rate, weight of product, permeability of packaging film, temperature and other factors. The benefits of MAP are reduced rates of respiration, ripening and softening, retention of natural colour, prevention of browning at cut surfaces and reduction of spoilage by moulds. However, the respiration rates of fruits and vegetables vary, as does their tolerance for elevated CO_2 and reduced O_2 levels. The fine tuning of MAP is, therefore, an area of active research conducted by the FPQEP.

Preliminary studies carried out in August-September, 1990, indicated that different films have varying effects on different crops because film thickness

and surface area are proportional to their permeability. Our plan for 1991 is to evaluate packaging films for permeability and to find optimum CO_2 and O_2 levels and storage temperatures for different crops.

Controlled Atmosphere Storage

Controlled atmosphere (CA) storage differs from MAP only in the fact that produce is stored in bulk, usually without pre-packaging. In CA storage, produce is subjected to specified temperatures, humidity, and gas concentrations. In collaboration with the Post-Harvest Program, 200 heads of cabbage supplied by Bassano Growers' Coop were stored under two gas atmosphere regimes:

- 7% CO_2, 2% O_2 at 1°C and 95% relative humidity (RH) and
- 3% CO_2, 2% O_2 at 1°C and 95% RH.

Another sample was stored under standard cold storage conditions of air at 5°C and 95% RH. Samples were evaluated for colour (Hunter Lab Colorimeter), weight and flavour (sensory evaluation) before placement in storage. Flaws in the CA control program allowed temperature, humidity, and gas concentrations to deviate from pre-set levels. As a result, the experiment had to be terminated early (after three months). While colour retention in these samples was acceptable, texture, flavour and overall appearance were not. Samples were severely dehydrated and had an unpleasant odour and taste caused by anaerobic fermentation. Samples stored in the filacell, however, retained their colour, were firm and did not show any changes in odour or taste. The cold storage trial is, therefore, continuing to the end of the six month study period.

Quality Changes in Saskatoons During Frozen Storage

A 24-month frozen storage study of saskatoon berries was concluded in 1990. Ten cultivars were evaluated for pH, colour (Hunter Lab Colorimeter), soluble solids (refractometer), moisture, and headspace (flavour) volatiles (Gas Liquid Chromatography) following frozen storage for 0, 6, 12, 18 and 24 months.

Although all cultivars exhibited minor decreases in all the quality attributes tested, no statistically significant changes were detected. The overall evaluation of the berries indicated that saskatoons can be kept in frozen storage for up to 24 months without deterioration in quality.

Physicochemical Characteristics of Saskatoon Cultivar

The same ten cultivars used in the frozen storage study were examined for their physical characteristics, including berry size, weight, number of seeds per berry, percent seed per berry and length of seeds. The 1990 data were consistent with data from previous years. For example the cultivar Thiessen still has the largest berry size and weight while cultivars Pembina and Regent were the smallest.

In addition, in 1990, we examined and compared these characteristics between berries picked early, (*i.e.* ripe, first week in August) and those picked late, (*i.e.* over-ripened, third week in August). We found that early picking ensures fairly sweet, tart and juicier berries as opposed to slightly sweeter, less acidic and drier, more shrivelled berries when they were harvested later.

Service

Quality Evaluation of Other Vegetable Crops

In collaboration with the Vegetable and Post-Harvest Program leaders, 32 early and late cabbage varieties were screened for colour retention using the Hunter Lab Colorimeter. Samples were taken at harvest and from CA and conventional cold storages after three months and six months.

Moisture and dry matter determinations were conducted on 40 cultivars of cooking onions. Moisture content was determined in 14 varieties of baby carrots and 51 cultivars of fresh pack carrots. Acidity or pH measurements were carried out on 20 cultivars of field grown tomatoes. Two cultivars of greenhouse tomatoes were evaluated for colour and flavour as well. Two cultivars of greenhouse cucumbers were evaluated for flavour.

Quality Evaluation of Potatoes

Potatoes continued to account for a major portion (60%) of the work in the FPQEP laboratories. Sixty samples were analyzed for sucrose; 56 samples were tested for reducing sugars and another 66 samples were analyzed for total glycoalkaloid (TGA) content. In the Culinary Laboratory, 555 samples were chipped and evaluated for colour (Agtron); 128 samples were processed as French fries and evaluated for colour and texture; 24 samples were both boiled and baked and subsequently evaluated for colour and texture.

Total Glycoalkaloid Testing of Potatoes

The FPQEP assisted ASCHRC and Agriculture Canada researchers in testing and monitoring potato cultivars and selections for total glycoalkaloids. TGA, a normal constituent of potatoes, contributes to the typical potato flavour. However, at high concentrations (>100μg/g fresh weight), it causes a bitter, burning taste. Potatoes with >20μg/g are regarded as unsafe for human consumption.

In 1990, Prairie Replicate Trial potatoes and freeze-dried samples from D. Lynch, Agriculture Canada, Lethbridge were analyzed for TGA. For 1991, the analytical laboratory will be seeking a faster and easier method for measuring TGA in potatoes. We and Agriculture Canada have begun comparing a new ELISA assay that measures solamine with the standard TGA procedure.

Quality Evaluation of Fruit Crops

Sixteen cultivars of saskatoon berries from the 1989 crop were tested for colour, form, texture, flavour and overall quality by sensory evaluation. Twenty-nine cultivars of raspberries also from the 1989 crop were also evaluated in the same manner. Twenty-nine cultivars of the 1990 crop were frozen and evaluated in January, 1991.

Ten cultivars of mongolian cherries from the 1990 crop were frozen and are undergoing evaluation for colour, pH, flavour (sensory evaluation), headspace volatiles (Gas Liquid Chromatography), moisture and soluble solids at present. The processing quality of these cherries is also being examined. The Culinary Laboratory conducted, upon request, several taste panels on other fruits and vegetables for commercial producers and processors.

Quality Evaluation of Special Crops

The Chemistry Laboratory analyzed the essential oils from 43 different herbs (about 2000 samples) by gas-liquid chromatography in order to determine the major components. Another study on basil selections was carried out in collaboration with J. Simon of Purdue University on basil selections. Identification of each peak was authenticated by comparison with pure standards.

Extension and Service Activities

Due to the absence of a food scientist during the first 7 months of 1990, extension activities in the program were significantly reduced. The two permanent technicians continued to provide technical assistance to industry, government and the general public. Extension services are gradually moving to normal levels since Janet Panford joined the staff as Food Scientist in August, 1990.

At the request of a food processor the Culinary laboratory is engaged in the development of a potato puff product. We are assisting another company in the development of infant food products from Alberta-grown horticultural crops. In addition, the FPQEP collaborates with the Food Processing Development Centre in Leduc on various projects involving Alberta-grown horticultural crops.

HORTICULTURAL ENTOMOLOGY PROGRAM

Leader: R. Esau
Technician: A. Tellier

The Horticultural Entomology Program conducts research and provides extension and diagnostic services. Research is directed toward major pest problems on selected horticultural crops. Extension assistance is given to Alberta's agricultural industry, to individual growers, and to Alberta Agriculture staff. Diagnostic services are provided to clients of the Regional Crop Laboratory and to ASCHRC researchers. Pest control recommendations are often made in conjunction with diagnoses rendered on specimen submissions from commercial and amateur producers.

Research Projects

Greenhouse Pest Management

Biological control of Western Flower Thrips (WFT) in cucumbers and peppers

The Horticultural Entomology Program provided on-site supervision and technical assistance to this research project organized by M. Steiner, Alberta

Environmental Centre, Vegreville, and supported by a Farming for the Future grant.

The objectives of this project were:

- to evaluate the efficacy of the minute pirate bug, *Orius tristicolor*, as a complement to the predatory mite, *Amblyseius cucumeris*, and
- to determine sampling procedures for *O. tristicolor*.

Commercially reared pirate bugs were not available in the numbers required for the project. Therefore, adult pirate bugs were collected in the field from June onwards. They were introduced at a minimum of one per plant into one green pepper and several commercial cucumber operations. Their efficacy was monitored weekly. As demonstrated in 1988-89, numbers of WFT adults were drastically reduced 2-3 weeks after introductions of the pirate bug. Sampling for *O. tristicolor* must be concentrated on the upper canopy, lateral shoots (growing tips), and flowers of the crop.

Assessment of the resistance of *Phytoseiulus persimilis* to a range of pesticides

In 1990, commercial growers reported poor establishment of *Phytoseiulus persimilis*. These predatory mites were being introduced into commercial greenhouses in numbers that vastly exceeded those recommended. M. Steiner conducted studies to assess the longevity and fecundity of the predatory mite from various suppliers while the Horticultural Entomology Program assessed the resistance of *P. persimilis* to commonly used pesticides. Predatory mites were obtained from the two major suppliers in Alberta and reared on two-spotted spider mite, *Tetranychus urticae*, on bean plants. Only adult female predatory mites were used in the tests. The experiment was carried out using the slide dip test method with Safer's Insecticidal Soap, Vendex, Thiodan, Kelthane, and Morestan at 1x, 2x and 4x label rates. For each pesticide rate, there were 20 replicates and four distilled water checks. Slides were dipped for five seconds and placed in air-tight containers. A damp felt mat was placed in the bottom of each container and maintained at room temperature. Mortality counts were carried out by assessing the response of the mites to light contact with a pin 24 h later. If mortality of the predators in the water checks was greater than 10%, the corresponding treatment was repeated. This project was partially funded by the Red Hat Co-op and is ongoing.

Pest Surveys

Saskatoon insect pests

Saskatoon growers were asked to participate in a province-wide survey whereby samples were to be sent to the ASCHRC. Six samples were received. The pests identified were: forest tent caterpillar (*Malacosoma disstria*), fruit tree leafroller (*Archips argyrospilus*), and a sawfly (*Hoplocampa* sp.). Several samples showing leaf deformities, including leaf galls, were also received. Galls were examined for the presence of eriophyid mites, sawflies and gall aphids, but none was found. From this survey, the main pest appeared to be the sawfly, *Hoplocampa*; this insect oviposits directly into the newly developing fruit and renders it unmarketable. Four clusters of berries yielded 14 sawfly larvae. An unsuccessful attempt was made to rear the larvae to adults. This survey will be intensified in 1991.

Dutch Elm Disease elm bark beetle survey

Thirty-one sites were monitored for Dutch Elm Disease (DED) vectors. Traps and lures were purchased by the cities of Red Deer, Calgary, Lethbridge, and Medicine Hat. A total of 150 traps and 60 lures were distributed in the central and southern regions of the province. These and firewood containment units were purchased through a trust fund set up by Curran's Landscaping and Irrigation Ltd. of Brooks. Traps were put up in June by cooperators and changed monthly until the end of October. Reading of the traps was done by the cooperating cities and staff at ASCHRC. Cleaning, screening and identification of beetles was all done here; 90 specimens were sent to the Biosystematics Research Centre in Ottawa for definitive identification. The beetle most frequently identified was *Hylesinus criddlei*, a secondary pest of ash. High numbers of these were collected from traps in Lethbridge and Calgary. Several spruce bark beetles (*Scolytus piceae*) were collected from traps in Banff and Red Deer.

Two firewood containment units, built with funds provided by the cities of Lethbridge and Calgary were installed at Coutts and Carway Customs for confiscated firewood. A trailer built by the ASCHRC was placed at Chief Mountain Customs in May and returned to the Center in October. Four trailer loads of firewood were removed from Chief Mountain, two loads from Carway, and another from Wild Horse Customs. Several American elm logs, confis-

cated at the Chief Mountain Customs, showed fungal staining and contained beetle galleries and many smaller European elm bark beetles (*Scolytus multistriatus*). All suspicious elm logs were double-bagged and brought back to the lab for further study, while the remaining firewood was destroyed.

Extension and Service Activities

Extension

- Presentations were made at various meetings, workshops, and short courses.
- Over 200 visits to greenhouses, interior plantscapes, farms and yards were made in response to requests from district agriculturists and growers.
- Several scientific reports, miscellaneous bulletins, newsletter items and reports were written.

Service

The horticultural crops entomology technician assisted the diagnostician and information officer with insect identification and advised ASCHRC colleagues on pest control in research greenhouses, plots and the Hargrave Building atrium. We also maintained cultures of mealybug predators and parasites, and with the information officer, maintained the Center's insect reference collection.

POST-HARVEST PROGRAM

Program Leader: J. Holley

The objective of the Post-Harvest Program is to maximize the longevity and quality of stored horticultural crops. Other responsibilities include diagnoses and determination of treatments for major diseases and disorders on potatoes, vegetables, turf, herbaceous and woody ornamentals.

The new post-harvest research wing of the Duncan Hargrave Building was completed in mid-August of 1990. In 1990, this program's most important goal was to make the new research facility function as reliably as possible. The Post-

Harvest, Vegetable, Food Science and Special Crops Programs are already using this new facility for post-harvest research.

Research Projects

Diseases of Potatoes

Early blight resistance screening

Potato vines infected with early blight (*Alternaria solani*) were ploughed under in the fall of 1989 to prepare for disease resistance screening in 1990. Two standard cultivars and 30 advanced breeding lines were planted in this infested soil. Early blight was estimated during the third week of September and each line classified as very susceptible, susceptible, moderately resistant or resistant. ND2042-02, FV7497-24, ND848-03, BR7093-24 and AV77531-01 were as blight resistant as Russet Burbank. MIN12823, ND2203-01, WIS76-17 and ND2566-04 developed as much blight as Warba, the standard suscept. All other test lines were either susceptible or moderately resistant to early blight.

Verticillium wilt resistance screening

Cultures of *Verticillium albo-atrum* and *V. dahliae* were grown on barley seed three weeks prior to planting. Two cultivars and 12 advanced breeding lines were planted with a mixture of this infested seed. Wilt symptoms were seen on foliage in the field for the first time at ASCHRC. Approximately 82% of the stand of Shepody, a variety known to be susceptible to *Verticillium* wilt, showed symptoms and died. Stands of FV7466-76 were reduced by 64%, WIS75-38 by 32%, FV7704-10 by 24%, and WIS77-44 and WIS80-01 by 13%. Stand reductions were less than 5% in all other lines including Russet Burbank, the resistant check.

In the past, the level of vascular browning in tubers was considered to be the most reliable measure of *Verticillium* resistance. In 1990, however, many plants in susceptible lines died before they could set tubers. Lower than expected levels of vascular browning were seen in these lines after harvest. Although the ranking of test lines was reasonably consistent with the 1989 data, this season's data must be subjected to covariance analysis to account for the effect of stand reduction before *Verticillium* resistance can be accurately assessed.

Fusarium wilt resistance screening

A virulent culture of *Fusarium oxysporum* was established on barley seed and used to inoculate two cultivars and 12 lines as described previously for the *Verticillium* trial. Symptoms of wilt followed by plant death were seen in the *Fusarium* trial as well. Stands of FV7466-76 were reduced by 48%, Shepody by 43%, FV7929-33 by 19%, WIS75-38 by 14%, FV7704-10 by 12% and F79054 by 5%. Stand reductions were less than 5% in all other lines including Russet Burbank, the resistant check. Levels of vascular discoloration in tubers were affected by stand reduction in this trial as described for *Verticillium*.

Rhizoctonia canker and black scurf resistance screening

Rhizoctonia solani was established on barley seed and used to inoculate two cultivars and 12 lines as described previously. Levels of black scurf did not allow reliable assessment of disease reactions. They were so low and inconsistent that there were no statistically significant differences among test lines. Estimates of stem area affected by underground canker did, however, provide a reliable measure of disease resistance. FV7929-33, MIN12251, F79054 and FV7466-76 were as resistant as Atlantic, the resistant check. BR7093-02, WIS75-38, WIS80-01 and FV7704-10 were as susceptible as Russet Burbank, the susceptible check. All other lines showed intermediate levels of resistance to underground Rhizoctonia canker.

Resistance to benzimidazole fungicides in the silver scurf pathogen

Loss of activity of two benzimidazole fungicides, Mertect and Easout, against the silver scurf pathogen, *Helminthosporium solani,* was first demonstrated in southern Alberta in 1989. In 1990, a storage survey, funded by the Alberta Potato Research Association, showed that most growers apply Mertect at 1/10 to 1/100 of the label rate. Highly resistant isolates of the fungus were recovered from farms where Mertect had been applied at below the label rate regularly for the past 5 years. Strains intermediate in sensitivity were recovered where application was intermittent, and sensitive strains from farms where no chemical was used. There was, however, one important exception. A highly resistant isolate was recovered from a farm near Lacombe where Mertect had never been used. This particular isolate was found on potatoes grown from seed imported from P.E.I. Silver scurf is not a problem in the P.E.I., so Mertect is routinely applied at 1/10 to 1/100 of the label rate to control

Fusarium dry rot alone. This finding suggests that a resistant strain of *H. solani* can be transmitted on diseased tubers from one farm to another, even over long distances.

Diseases of Turfgrass

Fairy ring control

The experimental fungicide ICI0523 was re-applied in July, 1990, at rates of 750, 500, 250, 125 and 0 kg ai/ha to 5 x 50 m strips at McCall Lake golf course in Calgary. Almost ½ ha of turf was treated with fungicide. At the beginning of the experiment there were a minimum of 25-30 fairy rings per strip. About one-third of these were in an advanced stage of development with extensive bare turf toward the center of each ring.

An average of only four mild rings per strip was seen in September, with no evidence of bare turf. The number of rings, however, was also significantly reduced in untreated strips, so it was concluded that excellent watering and fertilization in 1990 had contributed to ring fading. Fairway strips will have to be re-assessed early next spring.

Storage Trials

Controlled atmosphere storage of cabbage

Approximately 200 heads of April Green cabbage were donated to ASCHRC by the Bassano Grower's Co-operative for post-harvest colour and weight loss studies. All cabbages were stored at 1.5°C and 95% humidity. One third were stored in typical cold and the remainder in controlled atmosphere (CA) storage rooms. Cabbage in CA storage rooms was placed in altered atmospheres of either 7% CO_2 and 2% O_2 or 3% CO_2 and 2%O_2. After 3 months storage time had elapsed, problems with humidification in the new CA storages became apparent. Excessive shrinkage necessitated the pre-mature termination of this experiment. Deficiencies in the computer program have already been corrected and this should not occur again.

Calibration of cold and controlled atmosphere storage rooms

Many obstacles were encountered when the new post-harvest research wing was used for the first time in the fall of 1990. Achieving reliable, steady control of humidity and gas concentrations proved to be particularly difficult. It

became necessary for users to understand a complex computer language and become familiar with the design idiosyncrasies of the unit before its operational deficiencies could be understood and solutions found. Although a great deal of time and energy has already been devoted to ensure that this new research unit functions reliably, much more effort is still required. Each room will have to be tested individually for its ability to achieve and maintain pre-set levels of temperature, humidity, and concentrations of CO_2, O_2 and N_2 gas.

Service Activities

Samples from 10,000 ha of commercial potatoes were tested for bacterial ring rot (BRR) in 1990. Fourteen cases of the disease were confirmed. There was only one confirmed case in 1989. Many of the BRR positives were on the red-skinned variety, Sangre. There were 4 positives from Sangre fields near Taber, 2 from near Edmonton and 1 from Carberry, Manitoba. All fields were planted with seed that could be traced back to a common source. Because of this, it was necessary for the post-harvest scientist to attend a number of regional meetings to answer grower's concerns about this BRR outbreak. At the Alberta Potato Marketing Board Annual Meetings held in November, 1990, in Lethbridge, a motion was passed requiring table stock growers to plant only certified or better grade seed.

The Dutch Elm Disease (DED) Action Committee was very active in 1990. A large firewood containment unit was built at the ASCHRC for the Chief Mountain customs agents to contain confiscated firewood. Smaller units sponsored by the cities of Lethbridge and Calgary were installed at Carway and Coutts. A seminar was held September, 1990, at ASCHRC to train people from each participating municipality to recognize elm bark beetles. City personnel will now scan traps from their own areas for these beetles as soon as the traps are changed. W. Burn, parks manager for the city of Edmonton, was approached personally to be certain that Edmonton would become involved with DED prevention. He has responded positively to the DED committee's concerns and has asked that the Head of Horticulture for the City of Edmonton be included on our DED committee. Representatives from the Sherwood Park will also be included.

Extension Activities

Routine queries about the identity of potato and vegetable diseases and about storing potatoes, carrots, onions and other garden vegetables were dealt with as they arose. Potatoes from the ASCHRC and the Prairie Breeding Program were examined in the field or in the lab, and stained for BRR as needed. Occasional farm visits were made to diagnose serious shelterbelt problems.

Seminars were given as requested. A presentation on diseases of woody and herbaceous ornamentals was given at the ASCHRC pruning course. A seminar on storage management was given at regional potato meetings in Taber and at Carberry Potato Days in Manitoba. A presentation on CA storage was made at the Horticultural Congress and another on skin spot disease given at the Alberta Potato Marketing Board's annual meetings. Two chapters in the Potato Production Guide were edited and revised. A table listing all registered fungicides was added to the chapter on potato diseases in the *Guidelines for the Control of Plant Diseases in Western Canada*.

Participation continued on the Dutch Elm Disease Action Committee, the Alberta Potato Research Committee, the Western Committee on Plant Disease, and the Storage Committee of the Prairie Potato Council.

REGIONAL CROP LABORATORY PROGRAM

Project Leader: D. Kaminski

The southern Alberta Regional Crop Laboratory (RCL) provides disease, insect and plant identification as a service to both commercial and non-commercial clients. The lab is operated by a diagnostician and a seasonal technician. An information officer is supervised by the diagnostician.

The RCL received 1214 disease, insect, and plant identification specimens in 1990. This number was down 11% from the previous year due in part to the fact that specimens received for Bacterial Ring Rot testing were not recorded by the RCL as has been the case in the past. The relative proportion of

domestic vs. commercial specimens remained nearly the same as in 1989 and 1988.

The summaries that follow were detailed in the southern Alberta Crop Protection Newsletter, Vol. 15, No. 1 (January 1991). This information is also contained in the *The Southern Alberta Regional Crop Lab Report* - 1990, ASCHRC Pamphlet 91-8. Diagnostic records back to 1985 are kept on a microcomputer.

Interesting and unusual plant disease problems that came to light through the RCL in 1990 were: Zucchini Yellow Mosaic on greenhouse cucumbers, root lesion nematode on alstroemeria destined for a trial on soilbed cooling at the ASCHRC, *Entomosporium* leaf spot on saskatoon, and fungal leaf spots on poplar and aspen.

The carrot rust fly, *Psila rosae*, was discovered on garden-grown carrots and parsnips from the city of Calgary. This is the first documented infestation of this pest in Alberta.

The identity of a dodder, *Cuscuta pentagona*, from an alfalfa field near Rolling Hills, was confirmed in the RCL.

The Regional Crop Laboratory has finally come to reside in newly renovated and expanded facilities. The extra space and additional equipment (laminar flow unit and specimen storage fridge) affords a functional and pleasant working environment.

The diagnostician visited each district office in Region 2 (south-central Alberta) during the summer months in order to become acquainted with the district agriculturists and to see problems in the field. Another regular extension commitment was the editing of the monthly *Crop Protection Newsletter*.

The information officer dealt with a wide range of topics. Between May and December she answered 2132 phone inquiries and 120 walk-in inquiries. During the busiest month (May) there were, on average, more than 25 calls/day. The major subject areas are summarized in Table 2.

Table 1. Summary of plant disease, insect, and plant identification specimens received at the southern Alberta Regional Crop Laboratory (Jan. 1 - Dec. 31, 1990)

Category	No. of Specimens	% of Total	% Commercial
Plant Disease			
Woody Ornamental	259	33	5
Greenhouse Crop	129	17	79
Vegetable Crop	99	13	36
Fruit	81	10	20
Cereal	67	9	97
Oilseed	51	7	100
Herbaceous Ornamental	30	4	43
Interior Plant	28	4	18
Forage	17	2	94
Special Crop	10	1	89
Miscellaneous	3	<1	0
Total	774	100	42
Insects			
Household Pest	78	30	0
Woody Ornamental	49	18	4
Cereal	29	11	100
Miscellaneous	27	11	11
Vegetable Crop	23	9	4
Greenhouse Crop	14	5	79
Herbaceous Ornamental	12	5	0
Fruit	11	4	20
Interior Plant	9	3	25
Special Crop	4	2	100
Forage	4	2	50
Oilseed	1	<1	100
Total	261	100	22
Plant Identification			
Park/Yard/Garden	56	31	4
Annual Crop	27	15	93
Fallow	27	15	63
Pasture	19	11	11
Miscellaneous	19	11	54
Forage	14	8	43
Waste Area	11	6	0
Water Course/Slough	5	3	0
Brush/Forest	1	<1	0
Total	179	100	35

Other questions covered such topics as annuals and perennials, fruit, greenhouse production, herbs & spices, landscaping, organic gardening, rodents, soils, and tropical plants. The information officer also spent considerable time identifying plants, organizing the herbarium collection, editing and updating factsheets and pamphlets, and speaking to various groups. This position benefits all programs at the ASCHRC by freeing the specialists to conduct valuable research and extension to commercial growers.

Table 2. Major Subject Areas of Phone Inquiries to the Information Officer (May - December, 1990)

Subject	Number of Calls
Trees & Shrubs	405
Entomology	354
Fruit	173
Plant Pathology	160
Vegetables	99
Pesticides	79
Pruning	79
Turf	61
Potatoes	52
Weeds	46

WEED SCIENCE PROGRAM

Program Leader: R. Esau
Technologist: B. Kruger

The objectives of the Weed Science Program are:

- to improve existing weed control practices for vegetable, potato, fruit, nursery and special crops by evaluating commercial and experimental herbicides
- to assist with the diagnosis of herbicide injury and the identification of plants submitted to the ASCHRC Regional Crop Laboratory, and
- and to provide weed control information to commercial and non-commercial growers.

Further details of all research trials appear in the *1990 Weed Control Trials*, ASCHRC Pamphlet 91-14. All rates quoted in this program report are in terms of active ingredients per hectare.

Research Projects

Weed Control in Fruit Crops

To assess crop tolerance, diclobenil (Casoron 4G) was fall-applied to three-year-old saskatoons in a commercial orchard at Okotoks. When applied at 4.5-9 kg/ha, this herbicide did not injure the saskatoons. This trial provided data to support an application for the minor use registration of Casoron 4G. This product controlled wild buckwheat, green foxtail and redroot pigweed. It also controlled toadflax at the highest rate tested.

Weed Control in Nursery Crops

To evaluate crop tolerance and herbicide efficacy, granular formulations of trifluralin (Treflan, Rival), napropamide (Devrinol) and oxadiazon (Ronstar) were applied to Nanking cherry, forsythia and golden elder in nursery containers. The three species were unaffected by the herbicidal treatments in this test. In a second test, three graminicides (Poast, Poast HC and Fusilade DF) were applied to six woody ornamental species (forsythia, potentilla, saskatoon, spirea, Blue Danube juniper, and Little Giant cedar) grown in containers. These products did not produce any crop injury and provided good to complete control of green foxtail.

Weed Control in Potatoes

Five graminicides — clethodim (Select), sethoxydim (Poast), fenoxaprop-P-ethyl (Excel Super), DPX-Y6202 (Assure), and propaquizafop (Agil) — were evaluated for weed control in potatoes. None of these products caused any crop injury, and all controlled green foxtail, wild oats and volunteer barley. In a second trial, two formulations of bentazon (Basagran and BAS 351-40) were evaluated as postemergence treatments on four potato cultivars. Temporary injury symptoms were seen on some cultivars. Russet Burbank showed more injury than Norchip, and Norchip more than Atlantic, while Norland was unaffected. Potato yields were unaffected by bentazon and BAS 351-40.

Weed Control in Vegetable Crops

Onions

Bromoxynil (Pardner) was evaluated as a pre-emergent on onions. It was applied after weeds had emerged. Crop tolerance was excellent. This treatment was designed to control broadleaved weeds, particularly wild buckwheat, without affecting grasses (desired for preventing wind erosion). In a second trial, tolerance of onions to metolachlor (Dual), applied pre-plant, was assessed. The crop was unaffected by metolachlor; however, weed control was poor. The work with bromoxynil will be repeated, but that with metolachlor will be discontinued.

Vine Crops

In a trial with zucchini squash, clomazone (Merit) at 0.35 and 0.7 kg/ha was incorporated into the soil with a rototiller prior to seeding. In addition, two soil cover crops, namely barley and fall rye, which were desiccated with glyphosate before crop emergence, were also evaluated for suppression of weeds. The cover crops were seeded on May 7, the squash on June 4, and glyphosate was applied on June 7. Zucchini's tolerance to clomazone was good and it yielded higher than the non-rototilled check and the cover crop treatments. In a similar trial, cucumber was less tolerant to clomazone than was zucchini. Cucumber yields in clomazone treatments were significantly less than those in the hand-weeded check, due in part to inadequate control of redroot pigweed.

Peas

Processing peas were only marginally tolerant to RE 40885 (Benchmark) when applied at 1.2 kg/ha. The combination of trifluralin (Treflan/Rival) plus RE 40885 at 1.1 plus 0.4 kg/ha did not injure the crop and gave good weed control. A test was also conducted with five graminicides: fenoxaprop-P-ethyl (Excel), sethoxydim (Poast), clethodim (Select), DPX-Y6202 (Assure), and fluazifop-P-butyl (Fusilade II). Peas tolerated all of these products. In a third trial with processing peas, BAS 351-40 (Basagran Forte) applied postemergence caused some crop injury. Yields were neither significantly affected by the standard formulation of bentazon (Basagran) nor by BAS 351-40.

Cabbage

Pyridate (Lentagran), napropamide (Devrinol) and trifluralin (Treflan/Rival), alone and in various combinations, were evaluated for weed control and

crop tolerance in two cabbage cultivars. None of the treatments caused any significant crop injury. Applied at the 2-leaf stage of the crop, pyridate at 0.9 kg/ha was more effective in controlling weeds than when it was applied at the 4-leaf stage. It controlled lamb's-quarters that had not reached the 6-leaf stage, but not those that were more advanced. All treatments controlled redroot pigweed, but none controlled wild mustard. Only pyridate and trifluralin controlled henbit.

Weed Control in Herbs and Spices

The tolerance of six herb and spice crops (monarda, sage, hyssop, fenugreek, summer savory and basil) to 12 herbicidal treatments was tested in 1990 to confirm earlier results. Monarda and fenugreek were again found to be tolerant to ethalfluralin, whereas sage, basil and summer savory were not; hyssop appeared marginally tolerant. Linuron, applied postemergence, was phytotoxic to fenugreek, basil and sage, but not to the other three crops.

Oil yields were determined for monarda, hyssop and sage planted in 1989. Ethalfluralin and several other treatments provided essential oil yields in monarda that were equivalent to the hand-weeded check. Failure to control weeds after planting monarda drastically reduced oil yield the following year.

Herbigation

EPTC (Eptam) and metolachlor (Dual) were applied with a backpack sprayer to control hairy nightshade in dry beans. This was followed immediately by irrigation to simulate herbigation. Herbicides were applied after the initial emerging weeds had been controlled by cultivation. They did not cause any crop injury. Few weeds emerged in either the herbicide or the control treatments, so weed control could not be evaluated.

Herbicide Carry-over

Wheat, canola and potatoes were seeded across plots treated with imazethapyr (Pursuit) at 25-100 g/ha in 1989. Canola and potatoes were injured by imazethapyr soil residues, even at the lowest rate. Wheat biomass was significantly reduced by residues at or above 50 g/ha. A second recropping trial was begun in 1990. In the initial year of both tests, the entire plot area was seeded to pinto beans. These plots will be recropped in 1991 with the same three crops tested in 1990.

Extension and Service Activities

The weed scientist spoke at a number of grower meetings, short courses and workshops and presented a poster at the Weed Science Society of America meeting in Montreal. Articles were contributed to the *Crop Protection Newsletter*. Staff assisted Regional Diagnostic Lab with plant identification as required. Weed control recommendations were provided to growers by phone, office and/or farm visits. A weed field day took place on July 24 with 14 visitors in attendance.

Under contract with Saskatchewan Research Council, a trial entitled "Evaluate INCREASE for Yield Enhancement in Wheat" was conducted. The same experimental protocol was carried out at two Agriculture Canada research stations and at the University of Saskatchewan. The Weed Control Program also cooperated with two chemical companies in studying the persistence of triasulfuron (Amber) and sulfosate (Touchdown).

A literature survey for information on the biology and control of wild tomato (*Solanum triflorum*) turned up only a few references. Wild tomato has become a problem on the prairies, particularly in the production of lentils and, to a lesser extent, in potato, vegetable and cereal crops. Currently, chemical control recommendations for wild tomato are not available. Work was initiated to investigate the biology of this weed.

A report was prepared for the Research Appraisal and Planning Committee, a subcommittee of the Expert Committee on Weeds (Western Canada Section), covering eight vegetable crops. The weed scientist served as a council representative and on the executive of the Alberta Institute of Agrologists.

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APPENDIX I. METEOROLOGICAL REPORT

Summary of 1989 Weather Conditions

The first three months of 1990 had average temperatures 2-8°C above normal. Sunshine hours in February and March were 30% and 40% over the long-term averages, respectively. Total precipitation in 1990 at Brooks was 40% lower than the 30-yr. average.

The last frost in spring was May 17 and the first frost in fall was October 3, leaving a frost free period of 140 days. Total heat unit accumulation during this period was 2588 corn heat units.

Table 3. Environmental data recorded at the Alberta Special Crops and Horticultural Research Center, Brooks, 1990

	Temperatures (°C)				
	Maximum	Minimum	Mean	Precipitation (mm)	Sunshine (h)
January	6.8	-36.2	-5.1	10.1	84.2
February	14.4	-35.5	-7.4	7.5	150.2
March	18.9	-18.1	1.0	13.3	214.8
April	24.6	-13.5	6.1	10.4	220.5
May	26.5	-6.1	11.3	60.8	260.8
June	33.4	3.2	15.9	21.2	293.2
July	34.7	5.0	18.7	38.8	330.0
August	36.5	3.5	19.2	19.8	294.5
September	32.4	1.0	15.3	7.8	296.0
October	24.8	-9.2	5.3	2.8	153.7
November	18.2	-28.3	-4.0	4.4	81.4
December	11.0	-36.2	-12.7	1.5	70.5

APPENDIX II.
TERMS OF REFERENCE ASCHRC ADVISORY COMMITTEE

Purpose

The ASCHRC Advisory Committee is a permanent committee established to be advisory to the ASCHRC Director.

Membership

Membership on the committee is by invitation, and includes representation from industry associations and associated organizations. Representation is by appointment through the association or by the Director, ASCHRC.

1. Industry Representatives - Grower Organizations

   - Landscape Alberta Nursery Trades Association
   - Alberta Greenhouse Growers Association
   - Alberta Vegetable Growers Marketing Board
   - Alberta Fresh Vegetable Marketing Board
   - Alberta Market Gardeners Association
   - Alberta Potato Marketing Board
   - Pulse Growers Association of Alberta
   - Flowers Canada - Alberta Region
   - Fruit Growers Society of Alberta
   - Red Hat Co-operative

2. Industry Representatives - Non-grower

   - Alberta Potato Processors
   - Horticultural Supply Specialists
   - Empress Foods Ltd.

3. Associated Organizations

   - University of Alberta - Plant Science
   - Agriculture Canada Research Station - Lethbridge
   - Alberta Agriculture Regional Director (Region I or II)
   - Alberta Tree Nursery and Horticulture Centre - Director
   - Field Crops Branch, Alberta Agriculture - Head
   - Director - Plant Industry Division

4. Community Representative

5. Director, ASCHRC

Objectives

1. The committee shall regularly review and critique ASCHRC programs.

2. The committee shall recommend new research and extension program initiatives and assist in the establishment of priorities for existing programs.

3. The committee shall deal primarily with matters pertaining to ASCHRC research and extension programs, and not necessarily with broad industry related problems, *e.g.* marketing, except as they may influence program objectives.

Membership Responsibility

1. To attend all meetings as scheduled, and to represent their area of interest from an overall industry point of view.

2. To provide input to meetings reflecting the needs of agency members and producers which they represent to ensure that they be addressed by the ASCHRC. Written submissions are preferred.

3. In regard to Committee Objective #1, members should attend regularly scheduled **program** reviews in their commodity area. (These reviews are planned biennially.)